- 1. (Amended) A method for determining the temperature T at at least one location on the surface of a sample, comprising the steps:
- (a) measuring, at an oblique take-off angle and at at least one wavelength  $\nu$ , radiance at at least two linearly independent polarizations p1 and p2;
- (b) computing a polarized radiance ratio  $R_{p1}(\nu)/R_{p2}(\nu)$  of said measured radiances  $R_{p1}(\nu)$ ,  $R_{p2}(\nu)$  to determine the associated polarized emissivity ratio  $\epsilon_{p1}(\nu)/\epsilon_{p2}(\nu)$ , in accordance with the relationship  $R_{p1}(\nu)/R_{p2}(\nu) = \epsilon_{p1}(\nu)/\epsilon_{p2}(\nu)$ ;
- (c) applying at least one additional constraint to compute the value of at least one of the emissivities,  $\epsilon_{p1}(\nu)$ ,  $\epsilon_{p2}(\nu)$ , constituting said polarized emissivity ratio;
  - (d) determining the temperature T at said one location by solving the equation:

$$R_{n1}(\nu,T) = \epsilon_{n1}(\nu T) \times P(\nu,T),$$

wherein  $P(\nu,T)$  is the Planck function;

- (e) irradiating said surface with radiation including said wavelength  $\nu$ , and measuring reflectance  $\rho$  from said surface at said wavelength  $\nu$  and said polarizations p1 and p2 to thereby determine the reflectance-derived ratio  $1-\epsilon_{p1}(\nu)/1-\epsilon_{p2}(\nu)$ ; and
- (f) applying said reflectance-derived ratio as said at least one additional constraint in said step (c) for computing said at least one emissivity value.

- 9. (Amended) A method for determining the emissivity  $\epsilon$  at at least one location on the surface of a sample, comprising the steps:
- (a) measuring, at an oblique take-off angle and at at least one wavelength  $\nu$ , radiance at at least two linearly independent polarizations p1 and p2;
- (b) computing a polarized radiance ratio  $R_{p1}(\nu)/R_{p2}(\nu)$  of said measured radiances  $R_{p1}(\nu)$ ,  $R_{p2}(\nu)$  to determine the associated polarized emissivity ratio  $\epsilon_{p1}(\nu)/\epsilon_{p2}(\nu)$ , in accordance with the relationship  $R_{p1}(\nu)/R_{p2}(\nu) = \epsilon_{p1}(\nu)/\epsilon_{p2}(\nu)$ ;
- (c) applying at least one additional constraint to compute the value of at least one of the emissivities,  $\epsilon_{p1}(\nu)$ ,  $\epsilon_{p2}(\nu)$ , constituting said polarized emissivity ratio;
- (d) irradiating said surface with radiation including said wavelength  $\nu$ , and measuring reflectance  $\rho$  from said surface at said wavelength  $\nu$  and said polarizations p1 and p2 to thereby determine the reflectance-derived ratio  $1-\epsilon_{p1}(\nu)/1-\epsilon_{p2}(\nu)$ ; and
- (e) applying said reflectance-derived ratio as said at least one additional constraint in said step (c) for computing said at least one emissivity value.
- 13. (Amended) Apparatus for determining at least one emissivity value  $\epsilon$  from a surface of a simple, comprising a radiance sensor including a radiation detector, polarization selective means, wavelength selective means, and electronic data processing means, said sensor being configured for carrying out the following steps:
- (a) measuring, at an oblique take-off angle and at at least one wavelength  $\nu$ , radiance at at least two linearly independent polarizations p1 and p2;
- (b) computing a polarized radiance ratio  $R_{p1}(\nu)/R_{p2}(\nu)$  of said measured radiances  $R_{p1}(\nu)$ ,  $R_{p2}(\nu)$  to determine the associated polarized emissivity ratio  $\epsilon_{p1}(\nu)/\epsilon_{p2}(\nu)$ , in accordance with the relationship  $R_{p1}(\nu)/R_{p2}(\nu) = \epsilon_{p1}(\nu)/\epsilon_{p2}(\nu)$ ;
- (c) applying at least one additional constraint to compute the value of at least one of the emissivities,  $\epsilon_{p1}(\nu)$ ,  $\epsilon_{p2}(\nu)$ , constituting said polarized emissivity ratio;
- (d) measuring reflectance  $\rho$  from said surface at said wavelength  $\nu$  and said polarizations p1 and p2 to thereby determine the reflectance-derived ratio  $1-\epsilon_{p1}(\nu)/1-\epsilon_{p2}(\nu)$ ; and
- (e) applying said reflectance-derived ratio as said at least one additional constraint in said step (c) for computing said at least one emissivity value.